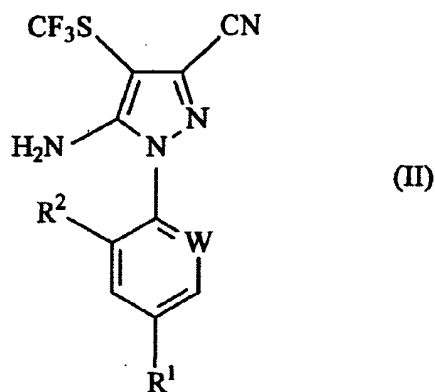


WHAT IS CLAIMED IS:

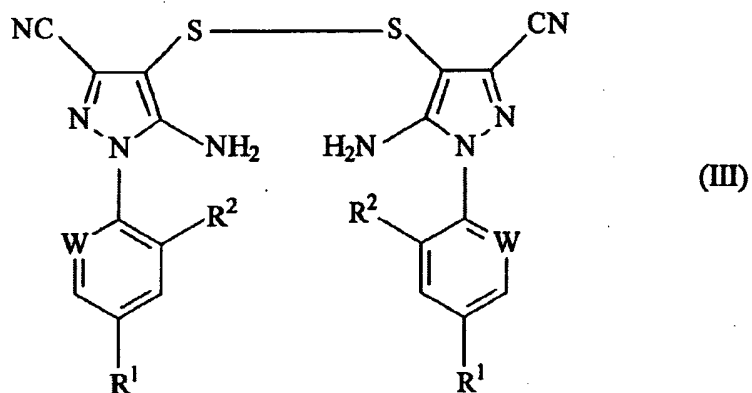
1. A process (B) for the preparation of a compound having the formula  
(II):



wherein:

- 5        W is nitrogen or  $-CR^3$ ;  
       $R^1$  is halogen, haloalkyl, haloalkoxy,  $R^4S(O)_n$ - or  $-SF_5$ ;  
       $R^2$  is hydrogen or halogen;  
       $R^3$  is halogen;  
       $R^4$  is alkyl or haloalkyl; and  
10        n is 0, 1 or 2;

said process comprising adding sulfur dioxide to a mixture comprising a  
disulfide having the formula (III):



wherein  $R^1$ ,  $R^2$  and W are as defined above, a formate salt, trifluoromethyl bromide and a polar solvent.

2. A process according to Claim 1, wherein the solvent is N,N-dimethylformamide.

3. A process according to Claim 1, wherein the reaction temperature during the addition of the sulfur dioxide is from about 35°C to about 55°C.

4. A process according to Claim 2, wherein the reaction temperature during the addition of the sulfur dioxide is from about 35°C to about 55°C.

5. A process according to Claim 1, wherein the sulfur dioxide is added over a period of from about 0.5 to about 2 hours.

15

6. A process according to Claim 2, wherein the sulfur dioxide is added over a period of from about 0.5 to about 2 hours.

7. A process according to Claim 3, wherein the sulfur dioxide is added over a period of from about 0.5 to about 2 hours.

5 8. A process according to Claim 4, wherein the sulfur dioxide is added over a period of from about 0.5 to about 2 hours.

9. A process according to Claim 1, wherein the molar ratio of trifluoromethyl bromide to disulfide of formula (III) is from about 3:1 to about 5:1.

10

10. A process according to Claim 2, wherein the molar ratio of trifluoromethyl bromide to disulfide of formula (III) is from about 3:1 to about 5:1.

15

11. A process according to Claim 3, wherein the molar ratio of trifluoromethyl bromide to disulfide of formula (III) is from about 3:1 to about 5:1.

20

12. A process according to Claim 5, wherein the molar ratio of trifluoromethyl bromide to disulfide of formula (III) is from about 3:1 to about 5:1.

25

13. A process according to Claim 7, wherein the molar ratio of trifluoromethyl bromide to disulfide of formula (III) is from about 3:1 to about 5:1.

14. A process according to Claim 1, wherein the amount of sulfur dioxide employed is from about 1.2 to about 1.5 molar equivalents relative to the disulfide of formula (III).

15. A process according to Claim 2, wherein the amount of sulfur dioxide employed is from about 1.2 to about 1.5 molar equivalents relative to the disulfide of formula (III).

5            16. A process according to Claim 3, wherein the amount of sulfur dioxide employed is from about 1.2 to about 1.5 molar equivalents relative to the disulfide of formula (III).

10           17. A process according to Claim 5, wherein the amount of sulfur dioxide employed is from about 1.2 to about 1.5 molar equivalents relative to the disulfide of formula (III).

15           18. A process according to Claim 1, wherein the formate salt is an alkali metal or ammonium formate.

             19. A process according to Claim 2, wherein the formate salt is an alkali metal or ammonium formate.

20           20. A process according to Claim 3, wherein the formate salt is an alkali metal or ammonium formate.

             21. A process according to Claim 5, wherein the formate salt is an alkali metal or ammonium formate.

25           22. A process according to Claim 18, wherein the formate salt is sodium formate.

             23. A process according to Claim 19, wherein the formate salt is sodium formate.

24. A process according to Claim 20, wherein the formate salt is sodium formate.

5 25. A process according to Claim 21, wherein the formate salt is sodium formate.

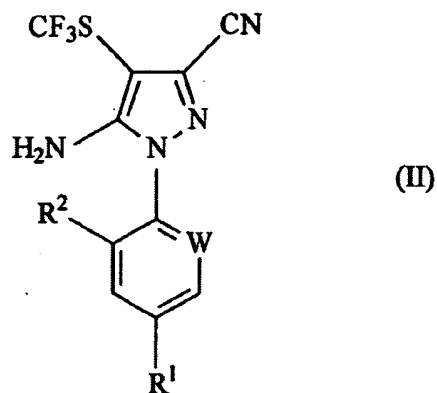
10 26. A process according to Claim 1, wherein the amount of formate salt employed is from about 4 to about 6 molar equivalents relative to the disulfide of formula (III).

27. A process according to Claim 2, wherein the amount of formate salt employed is from about 4 to about 6 molar equivalents relative to the disulfide of formula (III).

15 28. A process according to Claim 3, wherein the amount of formate salt employed is from about 4 to about 6 molar equivalents relative to the disulfide of formula (III).

20 29. A process according to Claim 1, wherein the disulfide of formula (III) is 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-cyanopyrazol-4-yl disulfide and the compound of formula (II) is 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-cyano-4-trifluoromethylthiopyrazole.

25 30. A process (B) for the preparation of a compound having the formula (II):



wherein:

W is nitrogen or  $-CR^3$ ;

$R^1$  is halogen, haloalkyl, haloalkoxy,  $R^4S(O)_n-$  or  $-SF_5$ ;

$R^2$  is hydrogen or halogen;

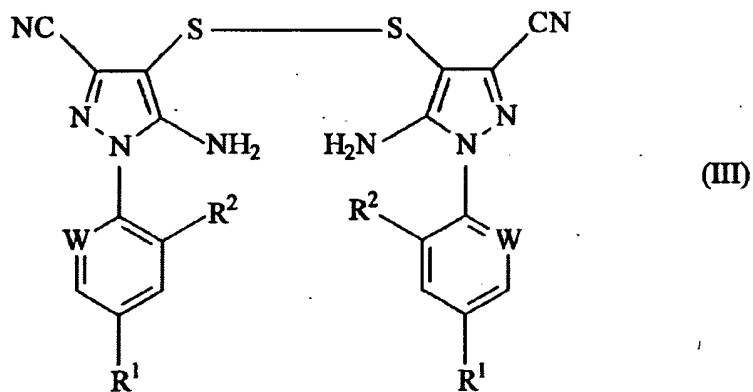
5  $R^3$  is halogen;

$R^4$  is alkyl or haloalkyl; and

n is 0, 1 or 2;

said process comprising adding sulfur dioxide to a mixture comprising a disulfide having the formula (III):

10

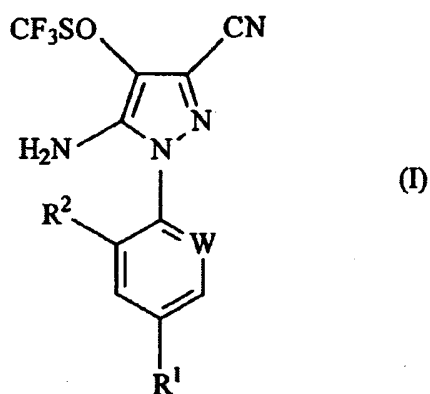


wherein  $R^1$ ,  $R^2$  and W are as defined above, sodium formate, trifluoromethyl bromide and N,N-dimethylformamide, the reaction temperature during the addition of the sulfur dioxide being from about 35°C to about 55°C, the sulfur dioxide being added over a period of from about 0.5 to about 2 hours, the molar ratio of trifluoromethyl bromide to disulfide of formula (III) being from about 3:1 to about 5:1, the amount of sulfur dioxide employed being from about 1.2 to about 1.5 molar equivalents relative to the disulfide of formula (III) and the amount of sodium formate employed being from about 4 to about 6 molar equivalents relative to the disulfide of formula (III).

31. The process according to Claim 30, wherein the disulfide of formula (III) is 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-cyanopyrazol-4-yl disulfide and the compound of formula (II) is 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-cyano-4-trifluoromethylthiopyrazole.

32. A process for the preparation of a compound having the formula

(I):



wherein:

W is nitrogen or  $-CR^3$ ;

$R^1$  is halogen, haloalkyl, haloalkoxy,  $R^4S(O)_n$ - or  $-SF_5$ ;

$R^2$  is hydrogen or halogen;

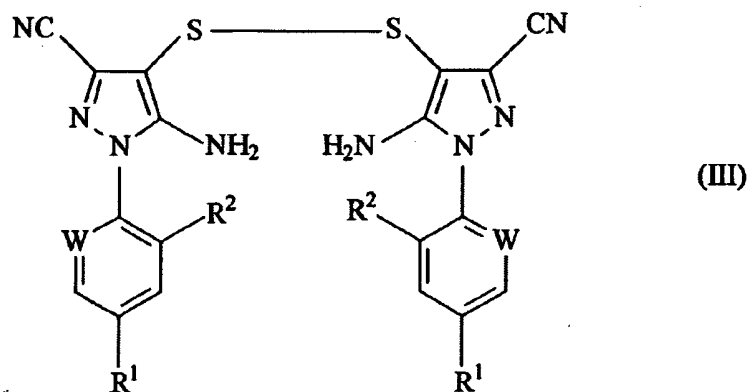
$R^3$  is halogen;

$R^4$  is alkyl or haloalkyl; and

n is 0, 1 or 2;

said process comprising:

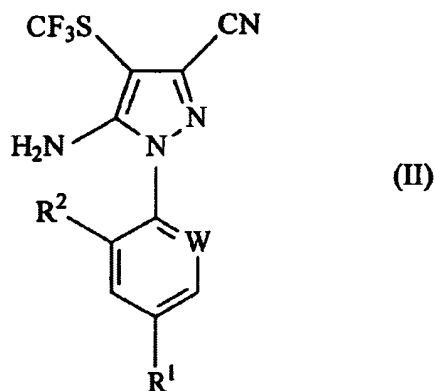
(a) adding sulfur dioxide to a mixture comprising a disulfide having the formula (III):



10            wherein  $R^1$ ,  $R^2$  and W are as defined above, a formate salt, trifluoromethyl bromide and a polar solvent, to afford a compound having the formula (II):



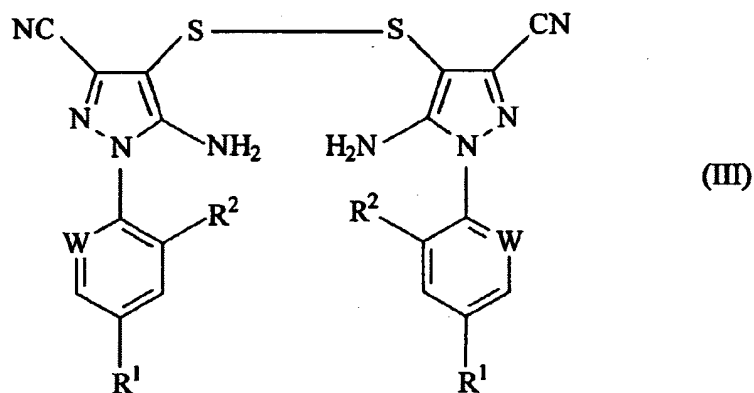
-27-



wherein  $R^1$ ,  $R^2$  and W are as defined above; and

- (b) oxidizing the resultant compound of formula (II) with trifluoroperacetic acid in the presence of a corrosion inhibiting compound to afford a compound having the formula (I).

33. A process (C) for the preparation of a disulfide having the formula (III):



W is nitrogen or  $-CR^3$ ;

$R^1$  is halogen, haloalkyl, haloalkoxy,  $R^4S(O)_n$ - or  $-SF_5$ ;

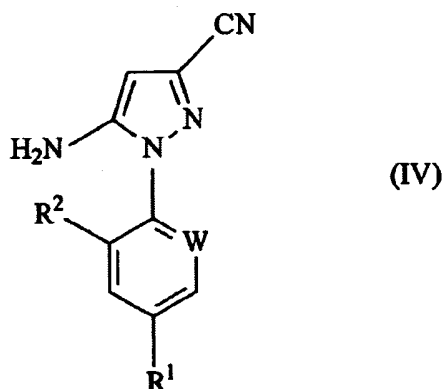
$R^2$  is hydrogen or halogen;

$R^3$  is halogen;

5  $R^4$  is alkyl or haloalkyl; and

n is 0, 1 or 2;

said process comprising adding sulfur monochloride ( $S_2Cl_2$ ) to a solution, in an organic solvent, of a compound having the formula (IV):



10 wherein  $R^1$ ,  $R^2$  and W are as defined above.

34. A process according to Claim 33, wherein the solvent is selected from the group consisting of toluene, dichloromethane, dichloroethane, an aliphatic or aromatic nitrile, and a mixture thereof, optionally in admixture with  
15 chlorobenzene.

35. A process according to Claim 34, wherein the aliphatic or aromatic nitrile is acetonitrile, propionitrile, methylglutaronitrile or benzonitrile.

36. A process according to Claim 35, wherein the aliphatic or aromatic nitrile is acetonitrile.

5 37. A process according to Claim 33, wherein the sulfur monochloride is from about 99.4 to about 99.9% w/w pure.

38. A process according to Claim 34, wherein the sulfur monochloride is from about 99.4 to about 99.9% w/w pure.

10 39. A process according to Claim 35, wherein the sulfur monochloride is from about 99.4 to about 99.9% w/w pure.

40. A process according to Claim 36, wherein the sulfur monochloride is from about 99.4 to about 99.9% w/w pure.

15 41. A process according to Claim 36, wherein the content of water is <1000 ppm, the content of ethanol is <1500 ppm and the content of ammonia is <100 ppm.

20 42. A process according to Claim 40, wherein the content of water is <1000 ppm, the content of ethanol is <1500 ppm and the content of ammonia is <100 ppm.

25 43. A process according to Claim 33, wherein the sulfur monochloride is added over a period of from 1 to 10 minutes.

44. A process according to Claim 36, wherein the sulfur monochloride is added over a period of from 1 to 10 minutes.

45. A process according to Claim 37, wherein the sulfur monochloride is added over a period of from 1 to 10 minutes.

5 46. A process according to Claim 40, wherein the sulfur monochloride is added over a period of from 1 to 10 minutes.

47. A process according to Claim 41, wherein the sulfur monochloride is added over a period of from 1 to 10 minutes.

10 48. A process according to Claim 42, wherein the sulfur monochloride is added over a period of from 1 to 10 minutes.

15 49. A process according to Claim 33, wherein the reaction temperature of the mixture at the start of the addition of the sulfur monochloride is from 5°C to 25°C.

50. A process according to Claim 36, wherein the reaction temperature of the mixture at the start of the addition of the sulfur monochloride is from 5°C to 25°C.

20 51. A process according to Claim 37, wherein the reaction temperature of the mixture at the start of the addition of the sulfur monochloride is from 5°C to 25°C.

25 52. A process according to Claim 40, wherein the reaction temperature of the mixture at the start of the addition of the sulfur monochloride is from 5°C to 25°C.

53. A process according to Claim 48, wherein the reaction temperature of the mixture at the start of the addition of the sulfur monochloride is from 5°C to 25°C.

5           54. A process according to Claim 33, wherein the compound of formula (IV) is 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-cyanopyrazole and the disulfide of formula (III) is 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-cyanopyrazol-4-yl disulfide.

10           55. A process according to Claim 36, wherein the compound of formula (IV) is 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-cyanopyrazole and the disulfide of formula (III) is 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-cyanopyrazol-4-yl disulfide.

15           56. A process according to Claim 53, wherein the compound of formula (IV) is 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-cyanopyrazole and the disulfide of formula (III) is 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-cyanopyrazol-4-yl disulfide.

20           57. A process according to Claim 33, further comprising purifying the disulfide of formula (III) thus obtained by:

- (a) heating the reaction mixture containing the disulfide under reduced pressure to remove hydrogen chloride;
- (b) heating the resulting degassed reaction mixture at atmospheric  
25   pressure, followed by cooling to about 30°C;
- (c) adjusting the pH of the reaction mixture to from about 6.5 to about 7 by adding a weak base; and
- (d) cooling the mixture to a temperature of about 5°C and isolating the desired disulfide by filtration.

58. A process according to Claim 36, further comprising purifying the disulfide of formula (III) thus obtained by:

(a) heating the reaction mixture containing the disulfide under reduced pressure to remove hydrogen chloride;

5 (b) heating the resulting degassed reaction mixture at atmospheric pressure, followed by cooling to about 30°C;

(c) adjusting the pH of the reaction mixture to from about 6.5 to about 7 by adding a weak base; and

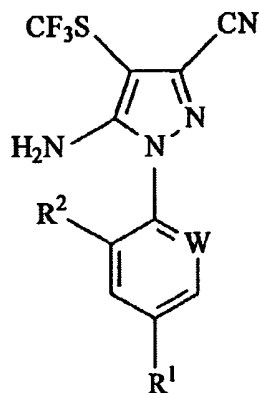
10 (d) cooling the mixture to a temperature of about 5°C and isolating the desired disulfide by filtration.

59. A process according to Claim 57, wherein the compound of formula (IV) is 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-cyanopyrazole and the disulfide of formula (III) is 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-cyanopyrazol-4-yl disulfide.

60. A process according to Claim 58, wherein the compound of formula (IV) is 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-cyanopyrazole and the disulfide of formula (III) is 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-cyanopyrazol-4-yl disulfide.

61. A process for the preparation of a compound having the formula (II):

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(II)

wherein:

$\text{W}$  is nitrogen or  $-\text{CR}^3$ ;

$\text{R}^1$  is halogen, haloalkyl, haloalkoxy,  $\text{R}^4\text{S}(\text{O})_n-$  or  $-\text{SF}_5$ ;

$\text{R}^2$  is hydrogen or halogen;

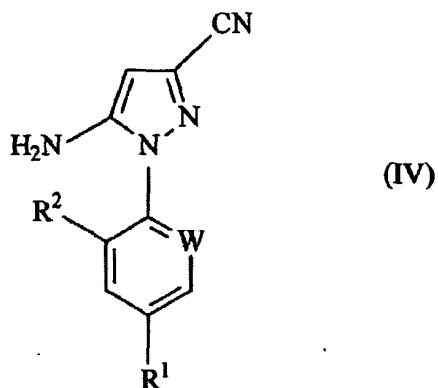
5  $\text{R}^3$  is halogen;

$\text{R}^4$  is alkyl or haloalkyl; and

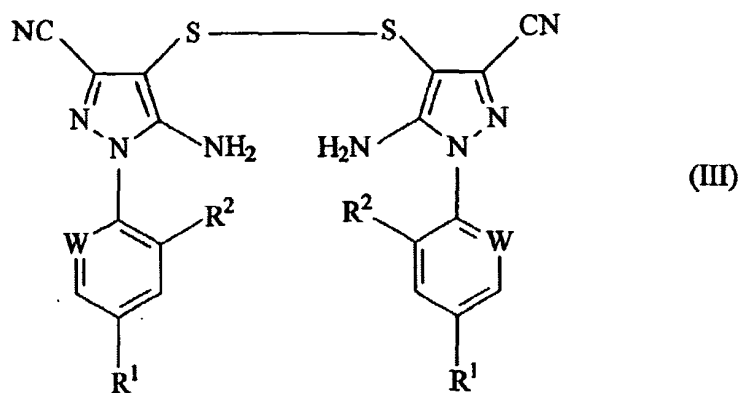
$n$  is 0, 1 or 2;

said process comprising:

10 (a) adding sulfur monochloride ( $\text{S}_2\text{Cl}_2$ ) to a solution, in an organic solvent, of a compound having the formula (IV):



wherein  $R^1$ ,  $R^2$  and W are as defined above, to afford a disulfide having the formula (III):



wherein  $R^1$ ,  $R^2$  and W are as defined above; and

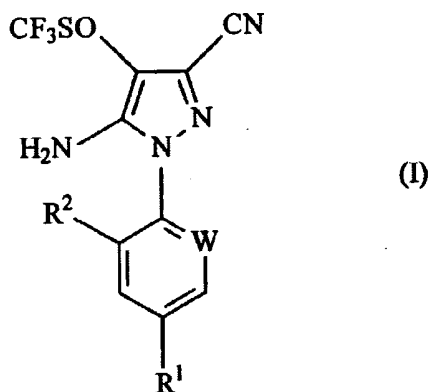
- 5 (b) adding sulfur dioxide to a mixture comprising the resultant disulfide having formula (III), a formate salt, trifluoromethyl bromide and a polar solvent, to afford a compound having the formula (II).

62. A process according to Claim 61, wherein the compound of formula  
10 (IV) is 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-cyanopyrazole, the



disulfide of formula (III) is 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-cyanopyrazol-4-yl disulfide and the compound of formula (II) is 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-cyano-4-trifluoromethylthiopyrazole.

- 5                    63. A process for the preparation of a compound having the formula (I):



wherein W is nitrogen or  $-CR^3$ ;

10                     $R^1$  is halogen, haloalkyl, haloalkoxy,  $R^4S(O)_n-$  or  $-SF_5$ ;

$R^2$  is hydrogen or halogen;

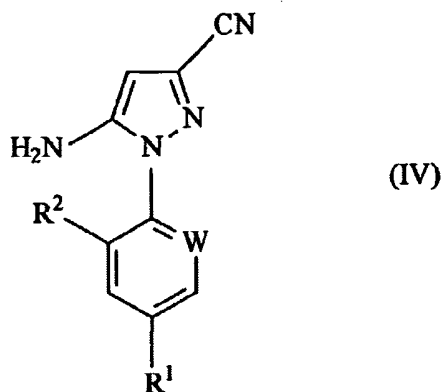
$R^3$  is halogen;

$R^4$  is alkyl or haloalkyl; and

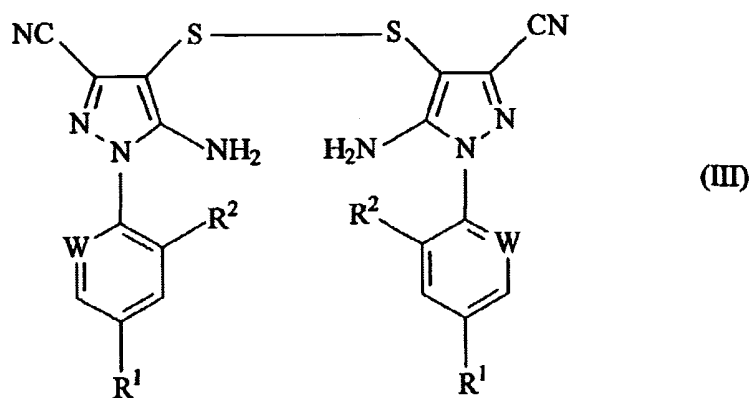
n is 0, 1 or 2;

15                    said process comprising:

(a) adding sulfur monochloride ( $S_2Cl_2$ ) to a solution, in an organic solvent, of a compound having the formula (IV):



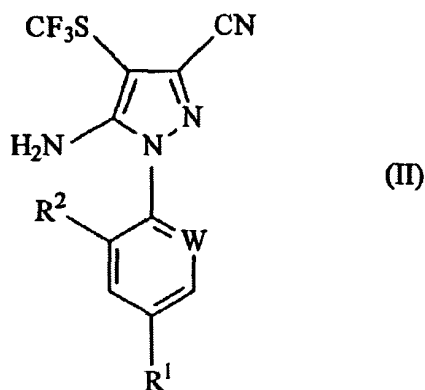
wherein  $R^1$ ,  $R^2$  and W are as defined above, to afford a disulfide having the formula (III):



wherein  $R^1$ ,  $R^2$  and W are as defined above;

5

(b) adding the sulfur dioxide to a mixture comprising the resultant disulfide having the formula (III), a formate salt, trifluoromethyl bromide and a polar solvent, to afford a compound having the formula (II):



wherein  $R^1$ ,  $R^2$  and W are as defined above; and

(c) oxidizing the resultant compound having the formula (II) with trifluoroperacetic acid in the presence of a corrosion inhibiting compound.

5            64. A process according to Claim 63, wherein the compound of formula (I) is 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-cyano-4-trifluoromethylsulfinylpyrazole, the compound of formula (II) is 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-cyano-4-trifluoromethylthiopyrazole, the disulfide of formula (III) is 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-cyanopyrazol-4-yl disulfide, and the compound of formula (IV) is 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-cyanopyrazole.

65. A process according to Claim 1, wherein:

$R^1$  is trifluoromethyl, trifluoromethoxy or  $-SF_5$ ;

15            W is  $-CR^3$ ;

$R^2$  is chlorine; and

$R^3$  is chlorine.

66. A process according to Claim 30, wherein:

$R^1$  is trifluoromethyl, trifluoromethoxy or  $-SF_5$ ;

W is  $-CR^3$ ;

$R^2$  is chlorine; and

$R^3$  is chlorine.

67. A process according to Claim 32, wherein:

$R^1$  is trifluoromethyl, trifluoromethoxy or  $-SF_5$ ;

W is  $-CR^3$ ;

$R^2$  is chlorine; and

$R^3$  is chlorine.

68. A process according to Claim 33, wherein:

$R^1$  is trifluoromethyl, trifluoromethoxy or  $-SF_5$ ;

W is  $-CR^3$ ;

$R^2$  is chlorine; and

$R^3$  is chlorine.

69. A process according to Claim 61, wherein:

$R^1$  is trifluoromethyl, trifluoromethoxy or  $-SF_5$ ;

W is  $-CR^3$ ;

$R^2$  is chlorine; and

$R^3$  is chlorine.

70. A process according to Claim 63, wherein:

$R^1$  is trifluoromethyl, trifluoromethoxy or  $-SF_5$ ;

W is  $-CR^3$ ;

$R^2$  is chlorine; and

$R^3$  is chlorine.